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An integrated roadmap of communication activities around carbon capture and storage in Australia and beyond

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Abstract

Extensive investment into research and development of low emission coal technologies is occurring around the globe. However, surveys suggest that most members of the general public are unaware of advanced coal technologies like carbon dioxide capture and storage (CCS). Further, those people who are aware of the term tend to have little understanding of the concept. This lack of awareness has become an increasing focus of policy makers internationally, and a number of governments have developed communication strategies to raise awareness of CCS and other low emission coal technologies and to help promote social acceptance of these technologies. The present research synthesizes the range of communication activities that have been planned or implemented since 2002 in Australia and internationally, and examines the strengths and weaknesses of these activities. The resulting "roadmap" enables interested parties to draw from the best communication processes available, to help increase capability in this area for the ultimate successful deployment of CCS. The paper makes a number of recommendations for industry and policy makers to provide a guide for future communication strategies regarding CCS.

Keywords: communication; carbon dioxide capture and storage; CCS; social acceptance;opinions, awareness; low emission coal;

1. Introduction

The risk from climate change and the links from anthropogenic causes are now generally accepted [1]. The rising concentration of atmospheric carbon dioxide (CO_2) is directly linked to the use of fossil fuels, and as a result, the global economy is pursuing pathways to significantly reduce the amount of carbon emissions released into the atmosphere from the use of energy [2]. With a predicted increase in fossil fuel use for many years to come [3], there is a need to find a future energy path that will meet our basic requirements for energy but also help to mitigate

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climate change [4]. Currently there are a range of potential solutions available, each representing a different value proposition for Australia. Carbon dioxide capture and storage (CCS) is one such solution.

If successful, CCS has the potential to avoid the release of large amounts of CO_2 to the atmosphere, while still allowing the continued use of coal to meet the world's growing energy requirements, particularly in developing countries [5]. The potential of CCS to avoid increases in atmospheric CO_2 has been recognized at the highest levels of government. This is best evidenced in Article 14(a) of the Gleneagles G8 communiqué, when it requested that the International Energy Agency (IEA) and the Carbon Sequestration Leadership Forum (CSLF) work together to accelerate the development and commercialization of CO_2 Capture and Geological Storage technology and to "*work with broader civil society to address the barriers to public acceptability of CCGS technology*".

Evidence suggests that over the past five years climate change has become one of the top three environmental concerns for most communities [6-8], with an associated number of people willing to pay to solve the climate change problem [9]. There has also been a significant increase in the media coverage of climate change issues and a general increase in public awareness. However, despite growing awareness of climate change, currently CCS remains a relatively unknown technology with a number of perceived risks.

Earlier examples of failed technology transfer (e.g. lack of public support for genetically modified foods) have demonstrated that societal acceptance will be crucial if CCS is to be accepted as a mitigation option [10]. Therefore, early engagement and communication about this technology is essential - given the substantial investment required to deploy the technology, any duplication can be ill afforded.

Early attempts to communicate about CCS provide an obvious opportunity for learning about the challenges involved in communicating a complex technological solution to the public. In 2007, the Australian Coal Association Research Program funded the present project, to develop an integrated roadmap of communication activities around CCS in Australia and around the world. This project focuses on the strengths and weaknesses of 5 years of communication activities, and highlights the learning outcomes arising from these activities. This research will benefit industry and policy makers working in the area of communication and raising public awareness of CCS by providing a guide for future communication strategies.

2. Methods

The project to develop an integrated roadmap of communication activities around CCS was undertaken between April and October, 2007. The first stage of the project involved identifying representatives from research, industry and government organisations that either have an interest in, or have completed work in, the area of CCS communication research over the last five years. This was achieved in part by a desktop review of individual cases, in which a bibliography of potential projects, publications and websites was compiled.

Once a list of potential representatives was identified, an email was sent to seek the researchers' interest in participating. Once approval was given, an email further describing the project and a series of interview questions was sent. To ensure sufficient detailed information was obtained, follow-up emails and telephone interviews were conducted. While the majority of researchers were contactable and telephone interviews were arranged, some researchers were unable to be contacted. In these cases, results are based on desktop reviews alone.

In addition, to ensure the process of identifying suitable representatives was comprehensive, a snowballing technique was used, whereby all participants were asked to nominate additional representatives to be included in the study. The project was also flagged at two international forums; the Carbon Sequestration Leadership Forum in Paris in March 2007, and the International Energy Agency meeting in Oslo in June, 2007. Although the study was designed to be comprehensive, some activities may not have been identified if they were not linked to existing networks or identified via desktop review. Hence, a number of informal activities and projects may not be adequately represented.

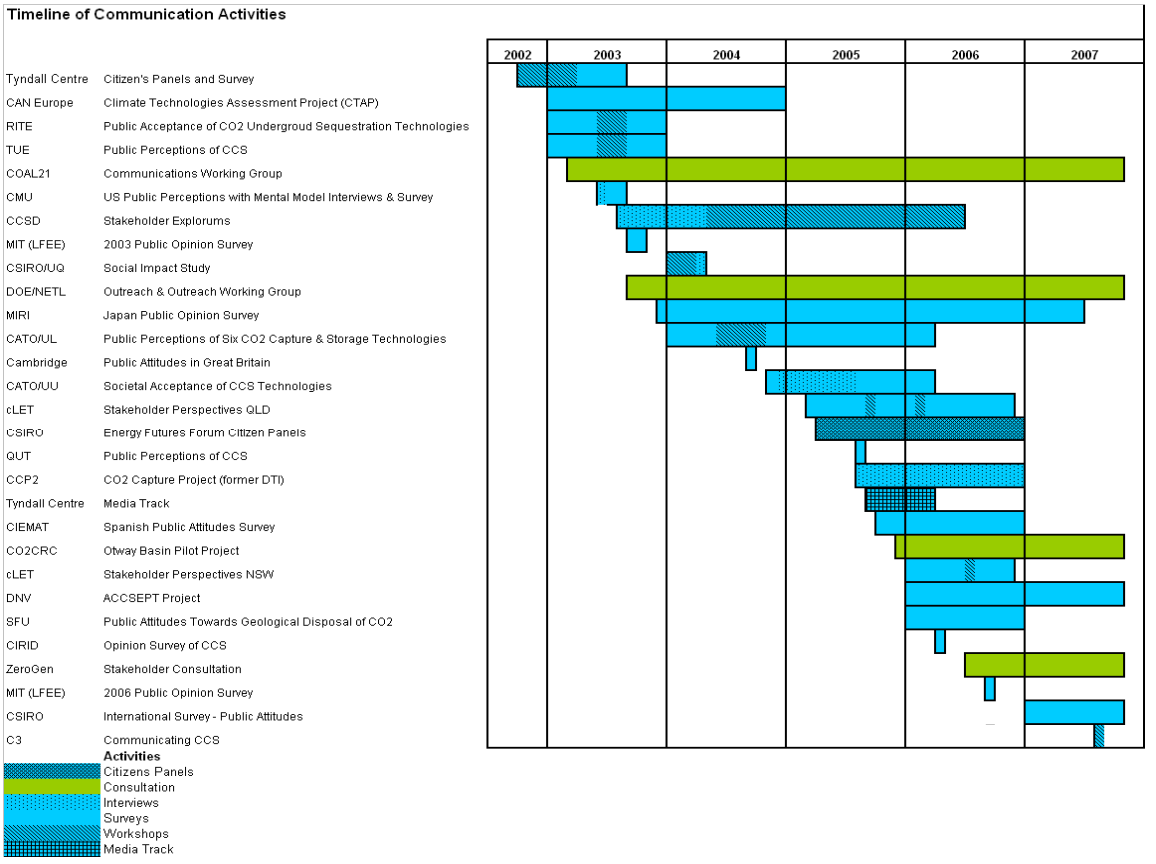
The second stage of the project involved analyzing individual activities. The research systematically consolidated past, present and future activities at Australian State government, Australian Federal government, and international levels. In total, 28 case studies of CCS related communication and research activities and 8 Australian demonstration projects were identified and reviewed. The processes and associated costs of the activities (where available) were examined in detail and key themes, including similarities and differences, were examined. Strengths and weakness of activities were identified and a list of the common concerns and benefits that have arisen was developed. Finally, a number of learning outcomes from the activities were identified, and a number of key

prerequisites for facilitating successful communication about CCS were highlighted. A number of techniques were used to illustrate the findings from the research. These are presented in detail in the full report and are described briefly below to highlight key points.

3. Results

Communication and research activities have predominately occurred in developed countries that have coal, oil or gas as their major source of electricity or industry base; such as in the Asia Pacific, Europe, North America and Australia. The first targeted communication and research activities to the general public about CCS started in 2002 in the UK. Since then, there has been an irregular increase in the number of ongoing communication research activities (see Figure 1).

Figure 1: Roadmap of CCS Activities



The main aim of majority of the communication activities was to identify public perceptions about CCS and to explore the issues and concerns which might affect its acceptance. Across all of the activities, there were a number of common concerns and benefits about CCS which were raised at different stages of the process (see Table 1). Typically, concerns outnumbered perceived benefits by almost two to one, depending on individual positions. Contemporary risk communication literature suggests that for society to accept a technology, the perceived benefits should outweigh the risks by a ratio of four to one [10, 11].

Table 1: Common concerns and benefits about CCS

BENEFITS	CONCERNS
It could provide a good bridge to the future	Safety risks of a CO_2 leak
If successful, can avoid large quantities of CO_2 from release to the atmosphere	The risk of contamination of ground water
Allows continued use of fossil fuels, which provides an economic advantage for some countries	Will it harm plants and animals near storage sites?
Energy security around the world	Assumption that CO_2 is explosive
Helps to clean up coal fired power plants for developing countries who need access to energy	Is it the wrong solution for climate change, a Band-Aid?
Allows emissions to be reduced without having to change lifestyle too much	Are there enough available storage sites?
	It appears to require a large infrastructure which does not necessarily exist today
	Long term viability issues
	Cost – economic efficiency
	Scale required for successful CO_2 mitigation
	It is an unknown technology
	Should not be pursued at the expense of renewable energy sources

Although not always available, the budget for the communication activities varied markedly, and influenced the scope and methodology employed in each of the projects. However, when taken as a group, analysis indicated a number of generic strengths and weaknesses of the activities (see Table 2). For example, little work has been done to inform the general public about CCS, and the majority of activities have been surveys used to inform research, policy and environmental NGO communities. Beyond the survey, there has been very little communication activity targeted at the general public, and as a result, overall public awareness of CCS is still low.

The research undertaken in the Netherlands by CATO and the University of Leiden [12] suggests that more traditional questionnaire methodologies are unsuitable for examining public perceptions of CCS as they produce unstable responses over time. In some cases, when information was provided solely as part of a questionnaire, individuals were more negative towards the technology. Conversely, when information was provided with increasing depth and interactivity, individual attitudes towards CCS tended to be more positive. This process seemed to allow participants freedom to find out more about the technology if they had an interest in it. This learning was supported by findings from research undertaken by CIEMAT (Research Centre for Energy, Environment and Technology) in Spain and the Massachusetts Institute of Technology (MIT) in the United States.

The positive effect of interaction is best highlighted where there was an opportunity for members of the public to participate in a dialogue about the technology. The workshops undertaken by the Centre for Low Emission Technology (cLET) in Australia [13, 14], and the Tyndall Centre in the United Kingdom [15] are good examples of interactive dialogue around CCS. It is apparent through these cases that when time is provided for questions, clarification of concerns, and reflection on the supplied information, participants tend to form more positive attitudes towards CCS. Having access to an expert to answer questions also assisted in the formulation of more positive attitudes. However, the number of individuals accessed using these interactive processes represents only a small proportion of the total population.

Table 2: Summary of the strengths and weaknesses of the communication activities

STRENGTHS	WEAKNESSES
Where information is developed using a range of experts with diverse viewpoints, its credibility is highest.	The high number of surveys in comparison to meaningful dialogue activities.
The independence of the facilitator is important and verifies the importance of the need for trust in the messenger.	Many of the activities were directed at students, and although a subset of the lay public, their views are not necessarily representative of society.
The rigor used in developing the majority of surveys, such as using interviews and focus groups to determine the correct language, means they are more robust than if they were developed without this process.	There has been little emphasis in the developing countries around these new technologies.
Engaging stakeholder outside the 'usual suspects' – some activities have gone beyond engaging policy makers, to engaging representatives of the renewable industry, environmental NGOs and members of the general public.	Demonstration projects have targeted their communications mainly toward key government stakeholders rather than the general public.
Meaningful dialogue was successful in engaging participants – some activities have ventured beyond the survey method.	The small number of communication activities occurring around the world – are we underestimating the power of public will?
Time for reflection in dialogue helped to bring about a more positive attitude.	Limited investment in communication activities compared with technical programs, resulting in continued low levels of knowledge about CCS.
Several of the projects confirmed that discussion of CCS with accurate objective information is likely to lead to more positive attitude formation.	The need to ensure this information is incorporated into school programs- education was highlighted in a number of processes.
Successful identification of the issues and concerns currently surrounding CCS.	Ensuring staff working in the industry understand the process of CCS and are equipped with the necessary information to discuss the process with friends and family.
Comparisons beginning to occur across countries to identify cultural similarities and differences towards CCS.	Quality of information provided was sometimes questionable.
Results have helped to provide some guidance to policy makers.	Language and temporal issues can be a problem when trying to scale processes to a global level.
Multi disciplinary approach has helped lift the credibility of the project.	Provision of information through survey can be seen as biased advocacy – in some cases this information had a negative affect on individual attitudes towards CCS.
A range of materials have been developed, although further time analyzing what is available would be useful.	Survey methods can be inconsistent – internet results appear to be biased.

The research undertaken has shown that information that addresses the public's issues and concerns tends to promote greater acceptance of CCS technology. The relative trust individuals placed in the information source was identified as a key factor influencing acceptance of CCS [13, 16]. Research undertaken in the Netherlands by the University of Leiden [16] confirms that communication about CCS from untrustworthy sources is likely to be counterproductive. Every case study that included a measure of perceived trust found that if information was provided by a trustworthy source, it was likely to have a more positive impact on the acceptance of CCS. In most cases, governments were seen as less trustworthy sources of information about CCS, but environmental organisations, academic and selected research institutions were deemed to be trustworthy.

Additionally, communication about CCS may result in more positive perceptions when stakeholders work together to provide information to the public rather than as a separate, "stand alone" organizations. Ter Mors et al. [16] showed this effect when two sources of information were involved (an industry proponent and a highly regarded environmental NGO) but did not investigate the effect with more than two stakeholders. However, Ashworth et al. [13, 14] presented combined information from six sources and this was viewed as credible and trustworthy by workshop participants.

A related issue is the ability of individuals to process the information that is provided to them. It appears that more discerning individuals, who are more media savvy and who have the ability to search and select information

for specific purposes, are likely to develop a more positive attitude towards CCS, particularly when given access to more information. The results of several studies suggest that people with a higher education background are often more accepting of the technology. Conversely those of lower socio-economic status and poorer educational qualifications tend to be more skeptical. The need for educating the young on the topic of climate change and energy technology arose in most workshops around the world, with participants recognizing the power of educating young people who will have a positive influence on their parents and other family members.

Finally, it was found the general public around the world continually demonstrate a strong preference for renewable energy technologies, and do not want CCS development to be at the expense of renewable energy sources.

4. Discussion

Whilst increasing year on year, the total investment in communication of CCS with the general public remains patchy and is inconsistent with the size of investment required to develop the technology. Limited budgets have adversely impacted on the scope and methodology employed in each of the projects. Although some projects have received significant funds for specific activities, it is clear that overall the expenditure in the area of public awareness has been insignificant when compared with the allocated budgets of the CCS technological research and development programs. The increase in activity from 2005 to date is most likely a reflection of the growing awareness of climate change and CCS as a mitigation option. It was also in 2005 that the G8 leaders requested that the IEA and CSLF work to address the barriers to public acceptability of CCS.

More than twenty years of risk communication research [11, 17] has indicated that, once formed, opinions can be slow to change. Hence, to reduce the risk that society chooses not to accept CCS, proactive communication about CCS is required if this technology is to have a chance of successfully contributing to climate change mitigation. Establishing more positive attitudes towards to the technology early in its life is likely to be far more beneficial than trying to overcome negative perceptions later on. Given the high number of people who know nothing about CCS, the earlier communication commences the better.

With rising public concern about climate change and the recognition of the need for action to address the issue, the opportunity is ripe for communicating CCS as a major mitigation option. Communication activities need to address the concerns of stakeholders as a way of moving the debate forward, however advocating for a single technology, such as CCS, is less likely to bring about acceptance and is more likely to have a negative affect on the general public. The research suggests it is far better to present the technology in the context of climate change with CCS being one of the many important potential mitigation solutions, alongside increased renewable energies and energy efficiency.

5. Recommendations

Based on the analysis and examination of key themes from the communication activities to date, the following recommendations are made for those working in the area of communication and raising public awareness of CCS:

- Proactively communicate about CCS to the range of stakeholders through dialogue and discussion.
- Partner with credible environmental NGO's and other trusted sources to develop communication materials which clearly outline the benefits of CCS and address the major concerns the public currently hold.
- Ensure an independent NGO is engaged to communicate about CCS activities.
- Invest in developing education curricula which addresses the topic of climate change, the role of coal in energy generation and solutions for mitigation.
- Find opportunities to engage high profile public figures to stimulate discussion around the issues being addressed by CCS. This would help to raise a more positive profile with communities.
- Review in more detail the range of communication materials already developed and test their applicability to the public using focus groups with a range of target audiences.
- Develop communication tools for a range of mediums including Internet, newspaper, television and radio.
- Where possible demonstrate support for renewable energy sources as part of the portfolio of solutions to

climate change.
- Identify resources to facilitate and support ongoing activity.

Any communication materials must clearly outline the benefits of CCS and address the major concerns the public currently hold. Industries and government partnering with environmental NGO's and independent experts would also help to foster greater acceptance of CCS and ultimately assists its development and implementation. This is particularly so for issues around long term liability, monitoring and verification.

In terms of educating the young, actively supporting the development of curricula which focus on climate change, the role of fossil fuels in energy generation and the range of solutions for mitigation would also be helpful in raising awareness of CCS. It is apparent that some countries are in the process of developing individual materials; however the opportunity to provide consistent materials that teachers can implement easily into the classroom should not be overlooked.

It is important to note that these recommendations are oriented at the Australian context and should provide a guide only for other countries. There is a need to recognize that no specific formula or recommendations will meet the needs of all future projects, given the various levels of development of CCS within countries, and differences in circumstances and cultures.

6. Conclusion

CCS is seen by many as an important option for mitigation of climate change. Despite growing awareness of climate change issues and renewable energy technologies, currently CCS remains a relatively unknown technology with some perceived risks. Over the past few years, a number of governments around the world have been working to develop a range of communication strategies and activities to raise awareness of CCS and other zero emission technologies with the ultimate aim of reducing the social risk to the technologies' acceptance.

One of the major outputs of this research is an easily accessible and detailed roadmap of efforts in communication around CCS that have taken place since 2002. What has been confirmed as a result of this research is that the general awareness of CCS remains low and that the majority of demonstration projects are continuing to direct their communication to stakeholders such as government, policy makers and NGO's rather than the general public. If governments and industry are truly serious in promoting CCS as a mitigation option for climate change, there is a need to be proactive in bringing CCS into the public spotlight.

It is clear that to progress public understanding and communication of issues related to CCS the early establishment of a coordinated communication approach is required. The interconnectedness of society today suggests that any negative effects of CCS that occur in one country will undoubtedly influence public perceptions in other countries. It also emphasizes the need for high quality concerted communication efforts for all projects. Currently this is happening in only a few isolated examples around the world.

When it comes to communicating about CCS, it is apparent that early action produces maximum benefits, particularly in countries where there is a number of clean coal activities planned in the next few years or where the introduction of an emissions trading scheme is likely. Such initiatives are likely to bring the cause of emissions and the cost of electricity to the forefront of public awareness. The more accurately informed individuals are about CCS, the more likely the technology is to have a smooth implementation, which will be necessary for the acceptance of the continued use of coal in Australia and elsewhere.

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